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Irrigated Pastures

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E. W. WHITMAN, and T. B. KEITH

Good pastures provide the cheapest feed for livestock

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COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO, UNIVERSITY OF IDAHO EXTENSION DIVISION AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING.

Irrigated Pastures

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D. L. FOURT, E. W. WHITMAN, and T. B. KEITH[1]

INTRODUCTION

GOOD pastures provide the cheapest possible feed for livestock. Animals on pasture gather their own feed. They produce meat, milk or wool at a lower cost than under any other system of management. Well-managed pastures provide palatable and succulent feed, rich in proteins, minerals and vitamins. The health of animals can be more easily maintained on good pastures than in feed lots. The effects of good pasture are carried over into the winter months in that they help to correct faulty winter feeding. Such pastures build up a supply of minerals and vitamins which are sometimes deficient in winter rations of livestock. Pastures aid in preventing livestock breeding troubles and provide ideal feed for pregnant animals.

Good irrigated pastures will carry up to as many as three cows per acre during the grazing season. A good average carrying capacity would be two animal units per acre. The term "animal unit" is employed to reduce the different kinds of livestock to one class. It is estimated that the amount of forage required to maintain one adult cow one year would be sufficient to maintain for the same period one horse, mule or steer, five hogs, or seven sheep.

Producing dairy cows usually will give more milk if they have some hay as well as pasture. High-producing cows should also receive some grain in addition to hay and pasture. Most dairy cows will keep up their body weights and produce approximately a pound of butterfat daily on good pastures. Yearling steers usually gain 1.25 to 1.50 pounds per day. Sheep and lambs make satisfactory gains on pasture alone.

Good, well-managed pastures will frequently produce a greater return per acre than can be realized from cash crops. Pastures demand less labor and their production involves less risk than the production of cash crops; annual expenditures for soil preparation and seed are not necessary.

SELECTION OF LAND FOR PASTURES

Good land will produce the best pasture. However, good pastures can be produced on many kinds of soil. The effects of poor soil conditions can be minimized by proper pasture management. Shallow soils, light sandy, or exceedingly heavy soils demand variations

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from the general recommendations made for good soils with respect to mixtures, fertilization, and irrigation. Even rough lands not suitable for growing cash crops respond to proper pasture management.

When rough land, suitable for leveling, is to be used for pasture it should be leveled before the pasture is seeded. This aids in the distribution of irrigation water and increases returns. Applications of barnyard manure and commercial fertilizers will improve any areas from which surface soil has been removed during the leveling process.

Good land management demands that the pastures on a farm become a part of the general crop rotation system. Pastures used for a number of years are usually referred to as "permanent pastures" as contrasted to "temporary pastures." Temporary pastures occupy the land for only a short time. Pastures on plowable land should not become permanent in the true sense of the word. The inclusion of pastures in the rotation system leads not only to the highest returns from the pasture enterprise, but will also increase the yields of all crops on the farm. The exact length of time that a field should remain in pasture depends on many factors. Four years is usually long enough and in line with soil-conserving practices.

Livestock management will at times require the use of land close to barns and corrals for pasture for a long period. The permanent use of land for pasture, except in the case of rough noncrop land, should be avoided as much as possible.

MIXTURES FOR PERMANENT PASTURES

No one mixture of grasses and legumes is best for all purposes. Generally a mixture of grasses and at least one legume is desirable. Grass-legume mixtures generally produce a greater amount of feed than grass alone. The pasturage obtained from such mixtures will also be higher in proteins and minerals. Practically all grasses slow down in their rates of growth during the heat of the summer. This summer slump in production can be held to a minimum by providing for a relatively high percentage of leguminous growth in the pasture. The rate of growth of the clovers is reduced less by high summer temperatures than the rate of growth of grasses.

Clovers are very desirable in a pasture mixture. A mixture may, however, contain too high a percentage of legumes. Legumes establish themselves more rapidly than grasses. Since they make a more vigorous growth soon after seeding than the grasses, there is danger that they will crowd out the young grass seedlings where the clover plants are too abundant. A second factor about overdoing the percentage of legumes in a mixture is the danger of bloat. The most practical methods of holding possible losses from bloat to a low level are to control the balance between legumes and grasses by using proper mixtures and rates of seeding, and by applying the right kinds of fertilizers. Nitrogenous fertilizers stimulate the

grasses, and applications of soluble phosphates result in increased growth of the legumes.

Table 1.—Pasture mixtures recommended for different soil and moisture conditions in Idaho

Field condition and kind of seed	Pounds of seed to use per acre
1. Well-drained soils—for general use	
Smooth brome	6
Orchard grass	4
Tall fescue	4
Ladino clover	2
Total	16
2. Poorly-drained soils—moderately alkaline or non-alkaline	
Smooth brome	6
Tall fescue	6
Strawberry clover	2
Total	14
3. Areas where irrigation water is not plentiful	
Smooth brome	6
Orchard grass	4
Crested wheatgrass	4
White clover	1
Alfalfa	1
Total	16

The mixtures shown in Table 1 may be varied to meet specific conditions. If tall fescue is not available, meadow fescue may be substituted. On sandy or gravelly areas where critical drought periods occur, tall meadow oat grass may be used in place of orchard grass. Since tall meadow oat grass has large seeds, it will be necessary to increase the rate in the mixture to at least 10 pounds per acre. Smooth brome should be a part of all mixtures except on poorly-drained land. This sod-forming grass is aggressive and provides good ground cover.

Reed canary grass does well on wet areas where the water level is near the surface of the soil. This grass will stand long periods of overflow provided the water is fresh. Stagnant water will kill out stands. It is not adapted to salt marshes or alkali areas. Reed canary grass may be seeded with alsike clover in areas not subject to overflow at the rate of 6 pounds of the grass and 1 pound of the clover. Including alsike clover will benefit the pasture and the soil. Since Reed canary grass develops pure stands the clover will be driven out in 1 to 2 years. On land subject to flooding Reed canary

grass should be seeded alone at the rate of 6 to 8 pounds per acre. The grass can also be established by root cuttings, or by the planting of pieces of sod.

Improved varieties of some of the grasses indicated above are now available. The Manchar variety of smooth brome has given uniformly better returns than commercial smooth brome. Seed supplies of this variety are becoming available rapidly. Several varieties of tall fescue are available. The Alta variety has given good results. Tall fescue has at times been criticized for lacking in palatability. There is some basis for this criticism if the grass is allowed to become too coarse as in under-grazing. This grass has given excellent results under proper systems of management. Abundant supplies of Alta fescue seed are available. The Tualatin variety of tall meadow oat grass can be used to advantage; it is later in maturity than commercial strains of this grass. No special varieties of orchard grass or Reed canary grass are available at this time.

Ladino clover is a large, rapid-growing form of white clover. This clover is recommended for general use. Its main advantage over the other clovers is its high productivity accounted for by its large size and rapid rate of regrowth after being grazed. Ladino clover is not as winter hardy as either white or alsike clover. However, very little trouble has been experienced with the use of ladino clover in the irrigated sections of southern and eastern Idaho. Ladino clover is not as aggressive as white clover. This may account for the fact that ladino clover pastures demand more careful management than pastures in which white clover is used to supply the legume. Alsike clover does well on low areas. It is, however, rather short-lived and not as aggressive as white clover. In areas of high alkalinity well supplied with moisture, strawberry clover will be found of value in the standard mixture. Two pounds per acre will be sufficient.

Alfalfa is a high-producing plant, especially during the summer months. However, it does not withstand close grazing. It will survive and produce under conditions of drought too severe for the survival of the small clovers.

TEMPORARY PASTURES

Since permanent pastures do not demand the annual preparation of a seedbed and an outlay for seed, they provide pasturage at a lower cost than can be expected from temporary pastures. Occasionally, however, the livestock enterprise on a farm demands more pasture than is available from permanent pastures. Temporary pastures may also be used to supplement permanent pastures during the heat of the summer.

Since temporary pastures occupy any given area only for 1 or 2 years it is necessary to use rapidly developing plants such as annuals, winter annuals or biennials.

Sudan grass makes good summer pasturage in the warmer sec-

tions of the state, such as in the lower portion of the Snake River Valley. Sudan grass is not recommended for the cooler portions of the state. Since the crop demands high temperatures it should not be seeded before the middle of May or early June. A well-prepared seedbed is necessary. Seed at the rate of 30 pounds per acre. Let Sudan grass get at least 1 foot high before grazing it. There is little danger of sorghum poisoning with the use of Sudan grass.

Winter rye provides pasturage in early spring and during the early portions of the summer. For best results it should be seeded during the middle of September or early in October at a rate of 75 pounds per acre. Where seed of winter rye is not available winter wheat can be used. It is best not to use winter barley. Winter barley is less hardy than either rye or wheat. Winter rye and wheat can often be used to advantage following a cultivated crop such as beans or early potatoes. It may then be used as a pasture or turned under for green manure the following spring.

Winter rye, wheat or barley can also be seeded for pasture in early spring. Such spring seeding will not provide pasturage as early in spring as can be obtained from fall seedings. Spring seedings generally have lower carrying capacities than fall seedings.

Sweet clover produces excellent yields of pasturage, especially during the summer months. The methods of establishing this crop do not differ from the methods recommended for establishing permanent pastures. Sweet clover may be seeded either alone or in combination with grass. A good sweet clover-grass mixture is made up of 6 pounds of sweet clover and 8 pounds of mountain brome grass. This mixture produces a more palatable feed and also leaves the soil in a better condition for the crops to follow than where sweet clover is used alone. Only grasses that have the ability to establish themselves rapidly have a place in a sweet clover-grass combination. Where sweet clover is used alone it should be seeded at the rate of 10 pounds per acre.

A fair amount of pasturage can be expected from sweet clover or sweet clover-grass combinations by the middle of the summer when the crop is seeded without a companion crop. Pasture lightly during the first summer; close pasturing may result in loss of stands or at least to greatly reduced yields the following year.

Sweet clover is an ideal pasture plant for land to remain in pasture for a short period. Sweet clover also makes a nuisance of itself in our seed-producing areas in that the plants volunteer readily. For that reason it is well to keep sweet clover out of areas specializing in the production of alfalfa and clover seeds. In such areas red clover can be substituted for sweet clover. Use 6 pounds of red clover and 8 pounds of mountain brome.

SEEDBED PREPARATION

The main essential of a good seedbed for pasture mixtures is firmness and availability of moisture near the surface. Tillage re-

quired to prepare such a seedbed varies according to the previous crop. Where the seeding follows a grain or hay crop and is to take place in the spring, the land should be plowed in the fall and left rough over winter. Fall plowing gives the soil time to settle so that a firm seedbed can be produced. The land should then be worked as early as possible in spring. Spring tillage operations will include disking, harrowing, floating, and packing. Early spring working will serve to compact the seedbed, save moisture, and eliminate many weed plants before seeding time. Where spring plowing is necessary it should be done as early as soil conditions permit. The soil should be worked down immediately after plowing. Seedbed preparation after row crops requires the same operations except that plowing can be omitted. A better seedbed can be produced without spring plowing after row crops than with spring plowing.

The availability of surface moisture is highly desirable. On moist soils, grasses should not be planted more than 1 inch deep. Under ideal conditions enough moisture is available in the soil to insure prompt germination and emergence of the plants. Where such moisture is available it will not be necessary to resort to irrigating up the crop. Irrigating before the plants come up frequently causes a crusting of the surface soil. Such crusts interfere with the emergence of the clovers and grasses. When soil crusting occurs before the plants are up, a light harrowing will sometimes help in breaking the crust.

Summer or early fall seedings following grain may be drilled in the stubble without any tillage operations provided the field in question is relatively free of weeds. However, the land should be irrigated immediately after harvesting the grain. This method is particularly adapted to areas where a winter grain crop can be grown on light sandy soils subject to blowing. Where summer or early fall seedings follow an early row crop, light disking and floating are the only tillage operations required before seeding.

New seedings respond to a high level of soil fertility. Soils low in organic matter will be benefited by applications of manure worked into the surface. Soil deficiencies can be corrected by applying 40 pounds of available nitrogen and 80 pounds of available phosphorus per acre.

TIME OF SEEDING

Early spring is generally more favorable for establishing pasture mixtures than any other time of the year. However, since clover seedlings are readily killed by frosts, seedings should be delayed until severe frosts are no longer expected. Where excessively weedy land must be used, it is well to delay seeding until several stands of weeds have been eliminated by cultivations prior to seeding. Early spring seedings can be recommended in that it allows the seedlings to establish themselves prior to the time when high temperatures may be expected. Also, under good conditions pasture

mixtures seeded early without a companion crop will provide some pasturage during the late part of the summer.

In portions of the state having longer growing seasons, such as the Twin Falls, Boise and Weiser areas, successful stands may be established from summer or early fall seedings. In these areas, seed the pasture mixture after an early crop, such as grain, peas, early potatoes or lettuce, has been harvested. These seedings will require more frequent irrigation than is usually needed for spring seedings.

In areas of the state where trouble is experienced with soil blowing, permanent pastures can be established to advantage by seeding the area in question to a fall sown crop of either rye or winter wheat. These winter annuals will aid in holding the soil during the fall, spring, and early summer months. They will serve to provide ground coverage and at the same time produce early spring and summer pasturage. The soil may then be prepared for the permanent pasture mixture to be seeded not later than the middle of August. Where summer seeding is used it is essential that the mixture be seeded early enough so that the plants will emerge by the last part of August. Careful attention must then be given to irrigation so that the grass and clover plants will make a rapid growth before winter sets in.

Late fall seeding of pasture mixtures on irrigated land is not recommended. Such fall seedings are too readily injured by winter temperatures and fields seeded at that time frequently become overrun with winter annual weeds.

COMPANION CROPS

The best and most vigorous stands of pasture mixtures are obtained where they are seeded alone, that is without a companion crop. The reason for this is that the plants can then develop without having to compete for soil nutrients and light with rank-growing cereal crops. Prolonged drying of the soil incident to the harvesting of the companion crop retards the growth and often reduces stands of pasture mixtures.

In areas where soils are subject to blowing, seeding with a companion crop may be advisable. The rank-growing cereals aid in holding the soil particles in place while the grasses and clovers become established.

Pastures established in competition with companion crops cannot be used during the first year. Careful attention must be given to the field after the removal of the companion crop. Keep the soil moist so that the grasses and clover can make a rapid growth.

Do not seed over 30 pounds of grain per acre if it is used as a companion crop to a pasture seeding. The competition between the grain crop and the pasture plants can be reduced by seeding the companion crop in rows 12 inches apart.

The increasing practice of seeding pasture mixtures in the summer following the removal of an early previous crop is largely ac-

counted for by the fact that farmers are having difficulties in establishing pastures in competition with companion crops.

SEEDING

Drilling of grasses and clovers is preferable to broadcasting, provided that careful precautions are taken to assure that the seed is placed at a uniform depth not exceeding 1 inch. It is best not to plant deeper than necessary to place the seed into moist soil. Since sandy soils dry rapidly, seeds should be planted deeper in them than in heavy, clay soils. Depth control may be obtained by having a firm seedbed and by the use of depth regulators on the drill. It is impossible to place seed at a uniform depth on a loose, rough, or cloddy seedbed. Spring seedings should be shallower than summer seedings since the soil moisture is nearer the surface and the soil does not dry out as rapidly.

When the pasture mixture is to be seeded with a drill the grass seeds of the mixture should be mixed and seeded through the grain-seeding compartment of the drill. The clover should be seeded through the legume attachment. If the grass and clover seeds are mixed together in the same seed box, they will separate to some extent during drilling operations and too much clover will be seeded first. Only small amounts of grass seed should be placed in the drill box at any one time. This will help eliminate separation of these seeds. It will also promote feeding of seeds through the drill and minimize the necessity for an agitator in the drill box.

Where a satisfactory drill is not available, the broadcast method may be used. This method does not require any special equipment. It can be done with a whirlwind seeder, with certain types of fertilizer spreaders, or by hand. Broadcasting by hand or with a whirlwind seeder does not give as uniform a distribution of seed as can be accomplished by mechanical means. The heavier seed will generally be thrown farther.

The seedbed for broadcast seedings need not be as firm as when the seed is drilled. However, the seedbed should be harrowed and rolled immediately after a broadcast seeding to bring the seed in contact with soil moisture. Rolling helps to pack the seedbed and maintain the moisture near the surface of the soil.

The broadcast method is not suitable for seeding a pasture mixture in stubble. This method does not provide the soil coverage necessary, especially for the larger seeded grasses.

All legumes should be inoculated with the proper bacteria prior to seeding.

PASTURE MANAGEMENT

Managing Pastures the First Year

The first principle of good pasture management is to handle the newly seeded pasture so that good stands of vigorous plants will be

obtained. Every chance should be given to the young plants to establish themselves firmly. This requires careful work in order to establish and maintain ideal conditions for rapid growth. Special attention must be given to irrigation. Apply water frequently enough to prevent surface drying of the soil. The amount of root growth produced by plants is directly proportional to the growth of the tops. Because of this, newly established pastures should not be grazed during the early part of the first summer. Under very favorable conditions enough growth may be produced the first year so that some pasturing may be allowable towards the end of the summer. When this is done livestock should be removed early enough from the newly established pasture so that the plants will have an opportunity to make a good growth before freezing temperatures occur.

In some cases competition from weeds will develop. Since pasture mixtures will consist of combinations of grasses and clovers, selective herbicides cannot be used to discourage the weeds. These herbicides are just as detrimental to the clovers in the mixture as to broad-leaf weeds. Clipping the field may be necessary where weeds are abundant. If this becomes necessary, set the sickle bar at least 3 inches high. Close clipping is detrimental.

A top dressing of barnyard manure is very desirable. This should be applied in fall.

Pastures established in summer should not be pastured until the following spring. Even then only light pasturing is in order. Plants in a permanent pasture are intended to last for a number of years. Give them an opportunity to establish themselves well before exposing them to heavy use.

Managing Established Pastures

New pastures should be used slightly. It is well to use caution in grazing, especially in early spring. Grasses make a better growth during the cool portion of the season than later. If for any reason the stand is not as thick as is desired, withhold livestock and apply fertilizers to thicken up the stand. A good pasture should provide complete ground cover.

Grazing too early in the spring should be avoided. The carrying capacities of pastures will be greatly increased by withholding livestock in spring until the grasses have made a growth of at least 6 inches.

Over-grazing is one of the most important causes for the low carrying capacity of pastures. It weakens the plants in that it does not allow for the accumulation of crown and root reserves. It may kill out some plants directly and weaken the others. Care should be taken to arrange grazing so that the pasture plants will enter the winter months with a growth of 3 to 4 inches. This is necessary to allow for storage of reserves within the plant to produce a strong, vigorous growth the next spring. Pastures should not become exercise grounds during the late fall and winter months.

At times the amount of growth on pastures may be greater than can be utilized by livestock. Where this happens it is good practice to clip the old growth. This will lead to a renewal of growth from the crowns of the plants. It is well in clipping to set the sickle bar so that it will be at least 3 inches above the ground.

Irrigating

Pastures require an abundance of water. Systematic irrigation is necessary for satisfactory results. The frequency of irrigation depends on soil conditions and seasonal factors. Maximum production is obtained only where plants do not suffer from lack of water during any portion of the growing season.

Irrigating pastures while livestock is grazing is injurious to the pasture plants. Where rotation grazing is practiced the time of irrigation should be synchronized with pasture utilization. Systematic, frequent, light irrigations can be expected to increase carrying capacities of pastures as much as one-fifth over improper applications of water.

Fertilizing

The best way to fertilize irrigated pastures is to top dress with barnyard manure each fall. This, combined with proper irrigation, may result in increased pasture yields as high as 50 percent on old pastures. In many cases, insufficient amounts of barnyard manure are available to do this. In that case commercial fertilizers can be used to advantage. Commercial fertilizers also can be used to supplement barnyard manures.

Commercial fertilizers may be used for several reasons, such as to supply elements lacking in the soil, to stimulate growth in early spring and during the middle of summer, to influence the relative proportions of grasses to clovers in the mixture and to effect the chemical composition of the pasture plants. The feeding values of forages from pastures and hay fields can be greatly improved by the wise use of commercial fertilizers.

In areas deficient in phosphorus the annual application of phosphate fertilizers to supply from 40 to 50 pounds per acre of phosphoric acid is highly recommended. Such an application increases yields and encourages the growth of legumes in the mixture. A good pasture should have a relatively high proportion of legumes to grasses. The legumes surpass the grasses in protein. They also make a more vigorous growth during the summer months than can be expected from grasses. Consequently, the use of phosphorus fertilizer will materially reduce the slump in pasture production during the summer months. Phosphate applications to pasture and hay lands provide the most efficient method of supplying ample amounts of this element to livestock feeds. Phosphate fertilizers increase pasture yields and improve the quality of the pasturage.

Applications of nitrogenous fertilizers will stimulate early spring growth. The applications of these materials in summer combined

with proper irrigation may also be expected to increase the growth of grasses during the summer months. Avoid very high rates of nitrogen applications because too much nitrogen interferes with the proper development of the legumes in the mixture. The growth of grasses is stimulated to a greater extent by nitrogen than is the growth of legumes. Consequently, if too much nitrogen is applied the grasses have a tendency to crowd out the legumes. Apply nitrogenous fertilizers at the rate to supply 40 to 50 pounds of nitrogen per acre. This calls for the use of 200 pounds of ammonium sulphate or 120 pounds of ammonium nitrate per acre per year.

Commercial fertilizers may be applied at any time during the year except when the soil is frozen. Applications on frozen soils may at times result in losses of the materials by being washed off parts of the fields by rains. Fall and early spring applications are preferred in that they stimulate early spring growth, however, applications may also be made during the summer months.

Fertilizer needs differ in the various parts of the state. The only elements needed in the irrigated parts of southern Idaho are nitrogen and phosphorus. Pastures in northern Idaho can be improved by applying nitrogen and sulphur. The sulphur is best applied in the form of gypsum at the rate of 100 pounds per acre per year. Response to gypsum can be expected only where the pastures contain legumes; the grasses do not respond to sulphur. Potash applications, in tests so far conducted, have in no parts of the state resulted in increased yields.

Scattering Manure Clumps

Often clumps of tall grass surround droppings of cattle. These clumps are not eaten and therefore reduce the carrying capacity of the pasture. This loss of forage caused by clumps can be avoided by using a spike tooth harrow as frequently as needed during the season to break up and scatter the manure.

Rotation Grazing

Grazing practices influence the life and yields of plants in a pasture. Periods of use must not conflict too much with the growth requirements of the pasture plants. Plants obtain their water and minerals from the soil through the roots. The bulk of their weight is produced from the sugars and starches elaborated in the leaves. This shows that the exposure of relatively large leaf surfaces to sunlight is essential to healthy, vigorous growth and the efficient production of forage. The amount of top growth in plants is directly associated with root development. Plants that are not allowed to make much top growth, as in continuous grazing, will be shallow-rooted. Vigorous early spring growth is highly dependent on root and crown reserves built up in the plants the previous fall. For this reason plants should enter the winter with a fair top growth. Continuous close grazing in early spring is detrimental in that it does not allow the grazed plants the opportunity to restore the root reserves used up in the production of early spring growth.

Spring grazing should not be started until the pasture plants have attained a height of 6 inches. At that time root reserves will not be greatly reduced; food is manufactured as rapidly as it is used up in the growth process.

Rotation grazing provides a system enabling the full use of pastures and at the same time provides the conditions essential to meet the growth requirements of the pasture plants. This is accomplished by providing periods for rest and regrowth between grazings. Such rest periods give the pasture plants the opportunity to develop their leaf areas and to make rapid rates of growth between periods of use. Rotation grazing will provide lush pastures during the recurring periods of use throughout the pasture season. This is especially desirable for high-producing dairy herds.

The alternate use of land for grazing and growth permits the application of irrigation water when animals are off the pasture. This avoids damage to the crowns of the plants, to the sod, and to the soil by tramping of animals.

Rotation grazing will increase pasture returns, especially on pastures containing clover and tall-growing grasses in the mixture. It will be found difficult to keep ladino clover in a pasture mixture unless some system of rotation grazing is used. Old pastures overrun largely by Kentucky blue grass will show little or no response to rotation grazing.

The number of fields required for a rotation grazing system depends upon soil and moisture conditions, and the intensity of grazing. Under general conditions three pastures are the minimum, and four are better. The use of a number of pastures rather than only one, as in continuous grazing, calls for more fencing and watering places. However, the increased returns, especially where ladino clover makes up an important part of the pasture mixture, will more than justify increased expenditures for fencing. Electric fencing can be used to advantage.

REVIVING OLD PASTURES

It is difficult to revive old pastures, especially where these pastures have been over-run by Kentucky blue grass. The management factors given above will help to increase the yields from such pastures. Rough lands not suitable for crop production had best be left in pastures permanently. Generally, however, it is best to plan to plow up such old pastures and to establish new ones. It is poor farm management to keep a given piece of tillable land in pasture for too long a period. The pasture area of the farm should be embodied in the general crop rotation. This will provide an opportunity to capitalize on the increased soil fertility resulting from pastures and proper pasture management.

IDAHONIAN, MOSCOW